

# Materials Science and Technology Division

## Industrial Partnerships for Energy

In the past three decades, researchers in the Materials Science and Technology Division have been engaged in world-class work in fuel cells and high-temperature superconductors. In partnership with industry, they have contributed to lessening our nation's dependence on oil and to improving energy efficiency.

### High-Temperature Superconductor Technologies

High-temperature superconducting technologies promise to improve how efficiently electricity is generated, transmitted, and used. The basis of all these technologies is a coated conductor tape developed at Los Alamos that carries electrical currents without any resistance or loss of energy. The tape serves as a wire that can be made into cables and coils. Applications span the whole range from motors, generators, transformers, transmission lines, and energy storage devices to medical tools such as ultrasensitive detectors and magnetic resonance imaging machines.



#### The Coated Conductor Tape

The tape, one-tenth the thickness of a human hair, can carry more than 100 amperes per centimeter width, or 100 times the amount of current (or electric power) that can be carried through an equivalent area of copper wire. This tape is being developed together with American Superconductor Corporation and Superpower, Inc.



The transmission cable (above) is a collaborative project between Los Alamos and Superpower, Inc.



This generator rotor (above) is being developed by General Motors and Los Alamos.



The magnetic resonance imager from Oxford Superconducting Technologies is being developed in partnership with Los Alamos.

### Fuel Cells: Los Alamos Contributions

Like batteries, fuel cells are sources of electric power. Fuel cells convert the chemical energy in a hydrogen fuel directly to electricity. Polymer electrolyte membrane (PEM) fuel cells, invented by General Electric and first used in the space program, have been the main focus of fuel cell work at Los Alamos. Materials researchers have been instrumental in bringing PEM fuel cells from the space program into everyday applications. They did so by lowering platinum catalyst loadings by a factor of more than 20—and thus lowering overall cost—while simultaneously improving PEM fuel cell performance.



#### From Applied Research to Commercial Product

Shown at left is the 10-kilowatt electrochemical engine, a complete PEM fuel-cell power system, developed through a joint collaboration between the Laboratory and General Motors (GM). This technology was further developed by GM, and it eventually led to a hydrogen-fuel-cell prototype vehicle called the HyWire (right).



HyWire photo courtesy of General Motors

### Fuel Cells for the “Hydrogen Economy”

Fuel cells may change radically the way energy is used worldwide. Pioneering research at Los Alamos, supported by the Department of Energy and industry, serves as the technical foundation for the ongoing worldwide effort to develop fuel cells for the coming hydrogen economy. As shown in the example below, direct methanol fuel cells (DMFCs), a spinoff from hydrogen fuel cells, can replace batteries in electronic devices.

#### Replacing Batteries in Portable Electronics

President Bush (below) tests a cell phone powered by a DMFC, a Los Alamos-licensed technology. The portable fuel-cell system (near right) under development by Los Alamos and Ball Aerospace is sponsored by the Defense Advanced Research Projects Agency. A military application is shown at far right.



White House photo by Paul Morse



Dean E. Peterson, [dpeterson@lanl.gov](mailto:dpeterson@lanl.gov), 505 665 3030  
Richard N. Silver, [rns@lanl.gov](mailto:rns@lanl.gov), 505 667 6832  
Kenneth R. Stroh, [stroh@lanl.gov](mailto:stroh@lanl.gov), 505 667 7933

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36. LALP-04-066

The World's Greatest Science  
Protecting America

